COURSE CODE:	*PBS 501*
COURSE TITLE:	Principles of *Seed Technology*
NUMBER OF UNITS:	*2 Units*
COURSE DURATION:	*Two hours of lecture and 1hr of practical per week*

COURSE DETAILS:

Course Coordinator: Dr. M. A. Adebisi
Email: mayoadebisi@yahoo.co.uk
Office Location: Room 253, COLPLANT
Other Lecturers: Dr. I. O. Daniel, Dr. (Mrs.) Dupe C. Akintobi and Mr. O.O. Ajani

COURSE CONTENT:

Elements of seed industry. Climatic and other requirements for seed multiplication. pollination- F1 hybrid seeds. Controlled multiplication. Determination of seed stocks. Protection against foreign pollen, isolation distances. Contract growing-Philosophy, principles and applications. Seed packaging principles, types and coat implications. seed marketing principles and objectives. Marketing organization and management. Sampling of agricultural seeds-types and techniques. seed blending-procedures and calculations. Seed laws. Plant Breeder's rights. Seed programme development-implication and evaluation.

Practicals: Purity analysis, seed viability and vigour. Sampling techniques-primary samples, composite-submitted and working samples. Seed health testing. Seed packaging. Types and differential permeability to moisture.

COURSE REQUIREMENTS:

This is a compulsory course for students in the Department. However, all students that register for the course are expected to participate fully in all the course activities and have minimum of 75% attendance to be able to write the final examination.

READING LIST:

1. 1. Technology of seed production and certification in Nigeria. By Joshua, A., Singh, A., Bal, S. S. and Rana, D. S. Produced by National Seed Service, Fed. Dept of Agric and FAO/UNDP.
2. Principles and practices of seed science and technology- by Copeland, L. O.
3. Project Report on National Seed Multiplication. Produced by National Seed Service, Fed. Dept of Agric and FAO/UNDP.

LECTURE NOTES

SEED AND GRAIN

The biological process by which seeds and grains are formed is basically the same, but the two are quite different with respect to functions and objectives of production.

Seed is meant to be used for producing good crops whereas grain is meant for food, feed or raw material. Therefore, both commodities have to be handled differently. Any attempt to use grain as seed is bound to reduce the potential yield and hence ought to be discouraged.

Seed is nature's bridge for conveying improved and superior characteristics between generations and to farmers fields and hence must be true to type.

Seed is a mature embryo which contains a immature plant in the form of a living embryo.

Seed differs from grain in that it represent the fruit of plant breeding research. Thus, the true value of improved yield lies on the genetic potential it embodies to assure high yield, quality produce, resistance against diseases, drought and insect pests, desirable maturity period, fertilizer responsiveness, efficient utilization of solar energy and other good attributes in the commercial crop.

The old proverbial adage, "As you sow, so shall you reap" sums up man's understanding of the importance of seed. The type of seed planted sets the limit to the effectiveness of the more expensive input like fertilizer, crop protection chemicals and management cost in food crop production.

Seed, in this context, is the basic input in agriculture. It is also an instrument of change. Seed serve as a catalytic agent to enhance productivity.

SEED INDUSTRY

Seed industry is an industry/unit which involves interlocking operations that will ensure production and distribution of high quality seed at the right time, price and quantity. Is an industry set to maintain quality of seed for farmers' utilization.

The basic components of seed quality are:

1. Superior, high yielding variety
2. Genetic pure(high purity level)
3. High germination percentage
4. Free from seed-borne diseases
5. Free from insect pest
6. Free from other crop seed
7. High seedling vigor
8. Good consumer acceptability
9. Free from noxious weed seed
10. Free from inert matter
11. Safe moisture content
12. Of good physical appearance
13. Field inspected and certified

The requirements are by no mean simple. But the seed men must endeavour to build into their seeds these quality factors so as to gain and retain the confidence of farmers.

FUNCTIONS OF SEED INDUSTY

1. **Plant breeding** including genetic research..There are different types of seed:

Breeders seed(UK) (pre-basic)	Breeder seed (USA)
Basic seed	Foundation seed
Certified seed-1st generation (C1)	Registered seed
2nd generation(C2)	Certified seed
Farmers seed	Farmers seed

2. **Cultivar assessment**: When the breeder releases a cultivar, it is then sent to seed expert at different locations for testing for distinctiveness, uniformity, stability and

value for cultivation and use (VCU).This is to ensure that the variety is superior in all ramification to the existing ones.

3. **Multiplication:** Must ensure rapid multiplication of seeds without undue contamination to the farming community.
4. **Processing**: This involves drying, cleaning, packaging and storage.
5. **Marketing and Procurement**: Any of the seed must be able to sell itself. Marketing is not a problem if the seed is good and seed are procured through different channels.
6. **Control**: Quality control includes legislation, certification and testing. Legislation is binding with regards to sale of seed (seed law).---minimum standard in UK, truth-in-labeling in USA. Certification is to ensure correct quality cultivar.pre-and-post control measures are in place
7. **Quarantine** : Plant materials containing disease and pests which are foreign to a country are detected at the country boarder post.
8. **Exte nsion Activity**: This is to allow farmers to benefit from the funding of research work in the area of seeds.

The philosophy of seed industry

The production of seed in the developed part of the world have developed from simple procedure of saving part of a crop to plant in next year into a highly specialized enterprise.

LECTURE TWO

Specific Benefits of seed programme / industry.

1. Increase in total yield as a result of introduction and distribution of superior variety and hybrid.
2. Increase in yield as a result of quality seed with better germination and more productive plots.
3. Increase in recoverable yield: result from greater varieties purity, more uniform maturation etc.
4. More efficient utilization of fertilizer, irrigation & pesticides because of greater uniformity of emergence and growth, more vigorous plots better stands etc.

5. Reduction in seed rate from 1ton 2ton.
6. Higher quality- less contamination with other varieties, more uniform maturation and less in mature or withered seed.
7. Less infestation of the land with weed seeds.
8. Less disease in soil and insect problem due to minimization of plots infected with seed borne disease in seed production.
9. More rapid efficient periodic replacement of variety with newer and better ones.
10. Facilitate introduction of new crops in Agriculture of a nation.
11. Contribution to Agric development of a nation.
12. Contributing to nation economy- GDP.
13. Employment opportunity etc.
14. Quality control in the country (standardization) e.g. quarantine.

The above are by no mean exhaustive of the benefits of seed programme or industry.

REQUIREMENTS FOR SEED PRODUCTION

The factors that determine seed production location are:

- Climatic
- Agronomic or soil
- Biological
- Social economic factors

A. **Two important phases are recognized in plot development**

-The vegetative: stems, branches, leave etc.

- The Reproductive: inflorescence, flower and seed.

The two are somehow antagonistic.

The purpose of producing seed is equally important. Some crops are grown for fruit or seed, cereals or pulses while others for their vegetative parts, grasses for leaves, jute for stems, cassava etc

To decide on the location of seed production enterprise, a number of factors have to be considered. These are climatic factor, Agronomy, biological, social and economics factor.

Climatic factors: light, temp, rain (water supply), wind.

Light: three aspects of light:- duration, intensity and colour.

Day length: flowering is influenced by day length, if flowers are kept in wrong day length, they remain vegetative, no fruit formation. The amount of cloud cover throughout the year is very important.

Note:- Sunshine provides suitable conditions for pollination, drying of seed and ripening of fruit seeds.

Temperature: some crops species have a critical temp. to switch from vegetative to reproductive phase. The chilling in winter makes some crops to produce flowers in summer.

Temperature influences i) sowing time especially in the soil.

ii) flowering, pollination, seed setting.
Warm weather favours all these activities at appropriate time.

Rainfall : Water is necessary by a seed crop during the period of vegetative phase followed by a relatively dry period for reproductive phase. In a dry area, irrigation is the supplements for rain. The advice is that we can guide against excessive and inadequate supply. Note that flowering, pollination and seed setting are helped by moderate humidity but drier atmospheric conditionings are for subsequent ripening.

Wind: strong winds especially. during reproductive phase can cause severe crop losses through lodging, sheltering and shedding of fruit or seeds. Is aggravated during heavy rain which soaks ripening ears in maize and increase the tendency to fall over.

B. Agronomic factors or soil factor

Soil should be fertile, neither acid nor alkaline deep and well drained to avoid water logging but retentive enough not to dry out easily. It should also be free from soil borne pests and diseases. Eelworms and for leguminous crop, it should have correct strains of rhizobium for nodulation.

C. Biological factors

Consideration must be given to the population of insect for pollination e.g bees. Avoid areas where plant diseases, insect pest and depredation of wild animals and birds are prevalent.

D. Social and Economic factors

Regions, Districts with large farms are preferred. The farms must be free of tenure (ownership dispute) and should have equipment necessary for all operations e.g from sowing to harvest.

Note:- borrowed equipment are liable to be contaminated with seed of other cultivars or spp.
Farms should be accessible to extension officer, certification officer, transportation of seeds, please note, above all, the seed agronomists or farmers must be intelligent, energetic, meticulous etc.

POLLINATION

Pollination is an important agronomic practice in seed production or multiplication. Pollination is the transfer of pollen grains from anther to stigma. In most species, there are several hundred times as many pollen grains as there are female ovules to be fertilized. An ovary may contain one or many ovules. Maize and rice contain ovules per ovary, Soyabean, cowpea, tomato, water melon have more than one ovules in each ovary.

Modes of pollination varies among crop species. Some are self pollinated and others are cross pollinated. Wind and insects e,g bees, butterflies etc are the chief pollinating agents of cross pollinating types. When pollen grains pollinate the same flower or another flower on the same plant, the result is self pollination but when they pollinate flower on another plant,

the result is self pollination but when they pollinate flower on another plant, the result is cross-pollination.

The pollination methods are determined by the floral biology and flower capability.

In pollination of F1 hybrid seeds:- In many cases, controlled pollination is necessary especially in cross- pollinated spp. Detasselling and male sterility are used in maize hybrid seed production. Hand pollination is also used to produce smaller breeder seeds. In some crop species e.g onion, cotton, etc honey bee-hives are built in close proximity to seed crop to enhance insect pollination.

The practical implication of cross pollinations is that the seed multiplication field must be adequately isolated from contaminants if pure seed is to be production. In self pollinated crops, the extent of natural crossing is so low that no protective measure or long isolation distance is required, except of minimal distance to avoid physical mixing of seeds.

Table1: Categorization of common crop plants as result of pollination methods

Self pollinated	Cross pollinated	Often crops pollinated	Vegetatively propagated
Rice, wheat, barley, Pea, cowpea, groundnut tomato, soybeans	Maize, millet, okra, alfalfa, cabbage, cauliflower, amaranths, onion, carrot, radish celosia, watermelon	Sorghum, cotton, jute, redgram,, egg plant, plant, pepper	Potato, sweet potato, yam, cassava, sugar cane, cocoyam.

LECTURE THREE

Seed Multiplication Chain

Seed is multiplied in controlled stage until the desired quantity is achieved. Each stage is assigned a class for identification such as breeder seed, foundation seed and certified seed. In self pollinated crops or in crops having a low multiplication ratio, itt may be expedient to have two classes of foundation seed instead of one: i.e foundation and registered seed.

Breeder seed

Seed or vegetative propagating material directly produced or controlled by the originating plant breeder or institution. Breeder seed provides the source for the increase of foundation seed. It is usually limited in quantity.

Foundation seed

Also know as elite or basic seed. It is the direct increase form breeder seed. The genetic identity and purity of the variety is carefully maintained in foundation seed. Foundation seed is the source of certified seed.

Certified seed

Certified seed is the progeny of foundation seed. Each variety requires unique treatment for its continued maintenance, though the treatment may be relatively simpler in self-pollinated crops than in crop which are largely cross-pollinated. Before attempting to produce a variety, it is imperative to familiarize with its:- reproduction behavior

- Reaction to diseases, day length and to
- Varietals type (pure line, open- pollinated, hybrid etc.

In multiplying self pollinated and cross pollinated crop varieties.

- producing breeders seed of recommended variety.
- Building up pure foundation seed.
- Avoiding mechanical mixture.
- Removing off- type plants.
- Proper seed processing, handling and storage.

In addition, for cross pollination crops, the following must be noted:

- adopting a limited generation plan for multiplication by renewing breeder seed frequently.
- assuring adequate isolation from other fields or crops.

In growing a crop for seed, use the cultural method adopted by the progressive farmers in the locality but with adaptation and precaution that seed production necessitate.

Vigilance is required during growing season but particularly at critical stages of the development e.g emergence, flowering etc.

Mechanization is common on a large farm but not essential.

At any periods, faults should be looked for, diagnosed, and remedial action taken if possible and if not, noted for next year action.

It is important that any chemical application for weed or pest control be made at correct stage of crop development.

The following points should be noted:

1. **previous cropping**: This may bring about volunteer plots of different cultivar/spp. Give sufficient interval before planting on a land to allow all unwanted seed to germinate another. Use crop rotation to control weeds. Note that some seed borne diseases can persist in the soil e.g head smut (fungi) of maize and nematodes etc. Keep them in check by a long interval between susceptible crops.
2. **fertilizers**: fertilizer application should follow normal local practices for food crop but with some modification for seed production and appreciating the fact that the value of the crop justifies additional cost. P & K are more important for seed crops than for food crop especially for pulses can be applied at sowing time to take care of crop needs. Please avoid very heavy application of N to cereal crop as this is liable to encourage foliar diseases, causes excessive vegetative growth, lodging etc.

3.Irrigation: Water may be applied overhead through sprinklers or on the surface through soil channels. Note that overhead irrigation may encourage foliar or seed borne disease and can be inimical to pollination. As a general rule, surface irrigation is to be preferred. Water should be given to match the following stages of crop developments.

Crop development stages	Water supply
1. Establishment vegetative growth to initiation of flowering.	Ample water
2. Flowering	Limited water (slight water deficiency promote poor seed setting).
3. Seed development	Ample water (to allow for greatest number of seeds).
4. Ripening	No water.

4. Weeds: objectionable in all crops. Reason

- they compete for soil water, nutrients, light etc.
- smolder the crop in delay harvesting and ripening
- impedes cultivation – they are poisonous – they are parasites witch weed, broom rape – harbour pests and diseases.

In seed crop, they are containment if harvested with the crop seeds. There are standard methods of weed control e.g rotation of crops, drainage, flooding, apply fertilizer to promote completive crop growth, herbicides, destroy weed plants etc

5. Diseases and pests: To a certain extent, the incidence of diseases and pests in a crop is influenced by climate as well as by their presence in the soil. One has to take this into consideration in selecting farms for seed multiplication. To control the diseases and pests, use the same basic control measures as for food and forage crops e.g burial of plot debris by ploughing, rotation of crops, seed treat and insecticidal sprays, isolation of farms from area of with incidence of air borne and insect borne diseases, (1km distance), good sanitation in seed stores, roguing, special prevention against rodents and birds.

6. Seed: seeds for sowing be treated with fungicides/insecticides in case of pulses and legumes, it may be necessary to inoculate seed with correct strain of rhizobium bacteria.

7. Sowing date: sow your crops when (climatic factors) temp and water are favourable and are likely to remain so until harvest time.

-Prepare land in good time to obtain suitable tilth. Fine tilth for small seeded and not needed for large seeds eg cowpea, maize etc

- dept of sowing depends on seed size

- sow some seeds directly on the field or in a nursery and their transplanting.

8. Seed rate: The quality of seed sown per ha determines the density of the plant population within the crop. Thick sowing gives rise to adverse mass of thin weak steams with few flowers stems and poor seed setting. The humid conditions within the crop discourage pollinating insects, promote fungi growth, delay ripening and so create harvesting problems. Use the right plant population. Experiments have shown that with increase in plant population, the yield of seed/ ha increase up to a point and beyond it no significant addition to yield is obtained.

9. Mechanical contamination: prevention of this is as important as that of genetic contamination by foreign pollen. Equally important is the prevention of mechanical. contamination i.e admixture of foreign seed – hence separate seed crop from another similar crop by 2 or 3 m or by a physical barrier – clean all implement /containers e.g tractor, seed drills, drivers, combine harvesters, threshers, wagon, lorries- After harvest, seed must be kept separate in stores. Good practice is to grow only one crop of any species on the same farm.

10. Roguing : Is the process of removing undesirable plants in our seed crop field. Undesirable plants in our seed crop whose harvested seeds contaminate the product must be removed early during growth. Such plants may be weed, plants of other crop species, plants of another crop of same species or simply off types or genetic variants, arising from within the crop. Roguing is the process of remaining these undesirable plants from the crop. The efficacy depends on the distinctness of the rogues and on the skill of the roguers.

Roguing is a practice which is limited in its effectiveness but it does contribute to maintenance of purity and is an essential operation in seed multiplication.

It should be done several times at different stages of crop develop especially flowering when cultural characteristics are most fully expressed and differences are most obvious.

Watch out in maize, rouging must be before pollen is shed. You must pay particular attention to parts of the field where rogues are most likely to be found e.g gateway sites of old stacks and places where animals may have been fed; (Roguers walks slowly not more than 3km/hr) upp root, each rogue and put in a bag strapped round the neck and burnt later.

LECTURE FOUR

DETERMINANT OF SEED QUALITY

1. **Source of seed**: Varietal purity and mechanical purity are attributes of quality which are influenced by seed source. Avoid variety of crop that is mixed with seed of another variety or seed.

2. **Inheritance**: inheritance differences among species and even down to cultivar level are biological fact which the seed scientist has no control over. The best we can do is to avoid seed with genetic weakness. The weakness might be contributed by maternal or paternal e.g

some cultivars of soybeans have tick seed coat susceptible to mechanical injury. Note, try to avoid genetic weakness which may create quality problem later.

3. **Field contamination**: Other crop seeds are contaminant and they derive from 3-major sources

i. Contaminants in the stock seed used for seed production

ii. Contaminants in the soil on which the seed are produced

iii. Contaminants in the equipment used for harvesting, drying cleaning etc

Of these three, soil contamination is probably the most important. We must produce seed on the clean land possible. Selection of land for the purpose should be based on the land history. Watch out for volunteer plants, similarly a field over grown with weeds the previous season, the soil will act as reserviour and replenish the weed population

4. **Growing condition**: Soil fertility, drainage, fertilizers, insecticide, herbicides applications and cultural practices have a great influence on both seed quantity and quality. Seed has a remarkable capacity to compensate for deficiency in rather than the quality.

5. **After Maturation (Before Harvest) condition**: As seed decreases in MC after maturation, they come more and more under the influence of field environment. In effect, the shorter the period of field storage (i.e the interval between maturation and harvest) which may be a few days or several weeks) the better for the seed. Remember field condition are seldom favourable for storage especially too low temp,. high RH and frequent precipitation. These can act singly or in combination to cause a substantial reduction in quality before the seeds are even harvested.

N.B field weathering –If crops are left unharnessed at right time, it will lead to seed withering (Vigour and germination problems, colour)

6. **Harvesting:** The method time and procedures to handle the harvested seed crop affect seed quality. Minimization of field exposure through harvest at a proper time is very critical because overly dried seeds are liable to mechanical injury. Climatic conditions may sometimes not be favorable for timely harvest. In this situation, harvest should commence as soon as weather permits. Equipment use for the harvest are always potential source of mechanical injury. Usually harvesting and threshing are accomplished by mechanical means. Note that if the mechanical action is not mechanically controlled properly then the same forces that thresh the seed can cause serious injury.

7. **Aeration and Drying**: field heat above combined with heat produce by respiration of the seed and green materials mix there with can quickly lead to determination of seeds. Timely and proper areation will remove field heat and reduce seed temperature and will also prevent the damage which can be caused by moisture migration in a bulk storage bin. Both aeration and drying are timely operations, if not done on time their effectiveness decrease/ diminish.

Note that the longer the delay in harvest and the on-set of drying, the greater will be the reduction in seed quality

8**. Handling**: Elevator, conveyor and other devices use in transporting seeds into processing plant and then on thin bagging can have important influence in the quality of seeds. Also note that every mechanical device use in handing seed is a potential source of seed injury and contamination. All conveyers must be properly cleared after they are used to handle a different variety or crop (preferably the self cleaning type). Pleases note that some seeds are more susceptible to injury than other, exercise care in handing the seed of different types, don't use auger to convey seed of soybean

9. Processing: Cleaning, size grading, density grading and threshing are all carried out to prepare seed for packaging and marketing. Consumer appeal must be enhanced. Note that processing equipment are also a source of contamination and should be thoroughly cleaned each time a new crop is handed.

10. Storage: before distribution of seed to a retail outlet, seeds must be stored for a period of time. Ensure that seed of high quality are always put in store as storage, irrespective of how favourable. Storage does not improve seed quality but maintain quality. Note that most problems do not originate in storage, it is only noticed there. Failure to stop 'pest in the incoming seed, fumigation should be carried out and germination test should be done periodically.

11. **Age**: chronological age is also an important determinant of quality. Seeds are alive and like all living things, will deteriorate with time and die. During ageing, seed vigour declare at a much more rapid rate than germination percent. Old seed may therefore have a reasonably good germination but be so low in vigour, but they are 'worthless in planting'.

12. **Uniformity**: A non uniform seed field produces non uniform seed lot. Portion of the seed lot may contain different levels of contaminant or even entirely different contaminant, soil fertility, -light, land, topography, non uniform management, etc. All could cause non uniformity and these affect the purity of the seed lots.

CONTRAST SEED PRODUCTION

Contract growing :Is the important practice in seed production. Is the growing of C_1 from basic seed and of C_2 from C_1. Is the most trickiest part of the operation. Huge quality handle here require planning and supervision

Why contract Grower?

- For large seed farms, in order to be able to produce more seed as large as possible. In seed company progress, you must try not to become a general farmer. Hence majority of seed companies have opted for contract seed growing i.e contract growers. In this way, the company itself does not get too involve in the agric operations and can them concentrate on processing, marketing etc. in his/her industry.

Characteristics of contract growers

- Must be a good farmers in the local community
- Must be intelligent, reliable, energetic and trustworthy. i.e prepare to take advice, must not do any nasty things, reliable
- Must be able to do think when seed experts are not there.
- Must have reasonable facilities e.g drying facilities, store, simple cleaning equipment approximate for his farm size, storage room/place.
- The location must be favourable for inspection especially for inspection point of view.
- Do not gave large contract to a new grower
- It must be profitable so as to make it appealing to farmers i.e because there must be a guaranteed price.

Organization of contract Growing

The key personnel is the production manager who co-ordinates and run all seed programmes depending on the company size, Is expected to have field staff, that will liaise with the grower for him. He must draw up progammes each year for each crop.

The information he must have are

1. production target each crop, guided by sales and marketing department. Do demand survey to kwon how much seed is needed next year.
2. How much basic seeds he has available for production
3. Have information from field staff for about what land is available for contract growing 2-3 months in advance.
4. He must draws up a master plan for his operations with flexibility for alteration. If there is a special variety that is likely to have problem, give it specially to an experienced (best) grower(s) and pay special attention to it. Also the particular land should be sited close to headquarters for close supervision.

Contract documents

This is a binding legal documents.

- Is a contract and has status in law court
- It must comply with the standard of legal proceeding in the country.
- It must be freely entered into by both parties.
- There must be no element pressure.
- Both parties have an equal standing in the contract
- There must be an agreement with where to drop the seed.
- Have contracts in two parts
- One part in respect of standard legal contract

- Second part contains all normal standard conditions that the company have.

LECTURE FIVE

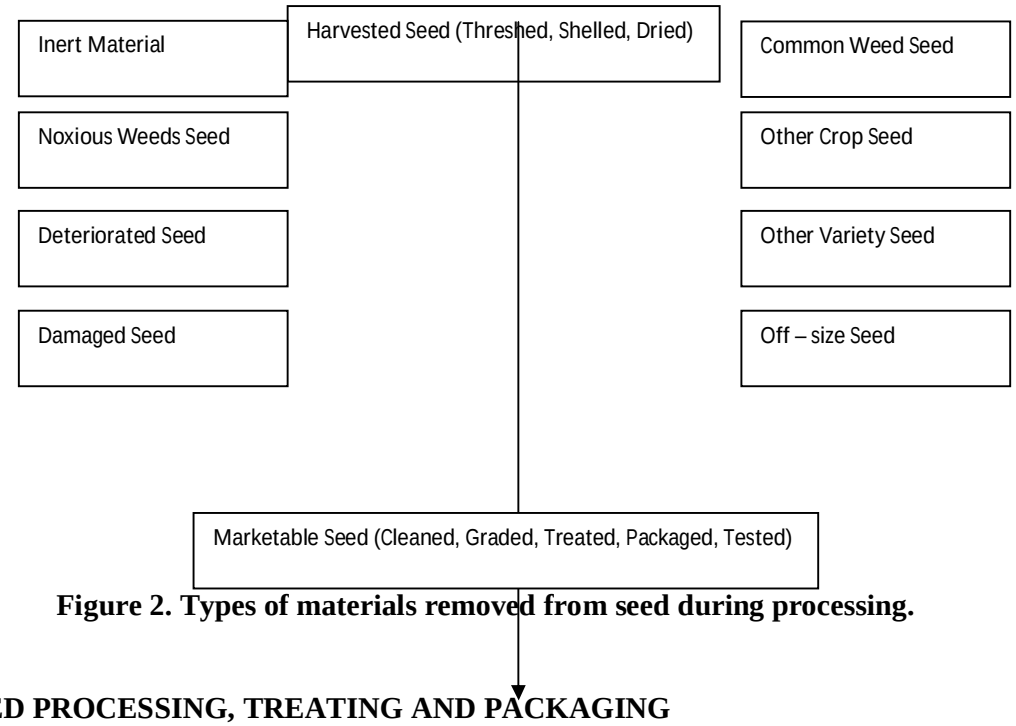


Figure 2. Types of materials removed from seed during processing.

SEED PROCESSING, TREATING AND PACKAGING

Seed processing is a vital part of the total technology involved in making available high quality seed of improved varieties. It assures farmers of high quality seed with minimum adulteration. If seed is not processed and handled properly, all pass effort of plant breeders in developing superior varieties and seed production may be lost.

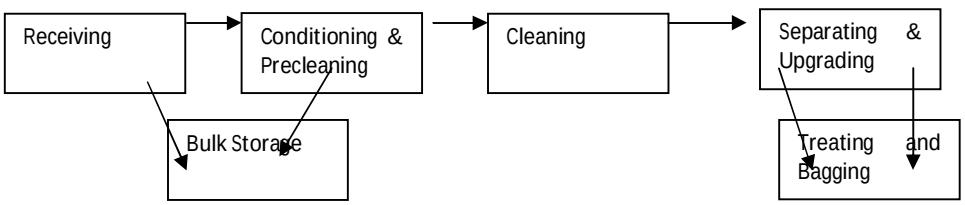
The purpose of seed processing is to remove undesirable materials such as merit matter, weed seed, other crops seed, broken seed, shriveled and small seeds to conform to prescribed quality standards, besides improving storability and palatability.

Principles

The quality of seed is improved during processing in two ways; separation of contaminating seeds of other crops, weed, and merit matter. (2) upgrading, or the elimination of poor quality seed. The ultimate goal of processing is to obtain the maximum percentage of pure crop seed with maximum germination potential. This concept is reflected in terms of the pure live seed percentage. This is calculated by multiplying the percent purity and the percent germination as the following example:

Seed lot x pure seed (95%), Germination %= 93%

Pure live seed 88.35percent (.95x.93x100)



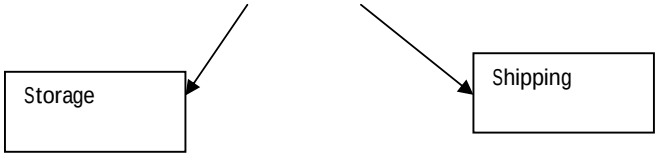


Figure 2: Essential steps in seed processing.

In a typical processing sequence, the first operation is pre-cleaning to remove trash and appendages from the seed. The next step is basic cleaning and grading followed by specific operations. When all undesirable materials have been removed treatment of seed with insecticides &fungicides may be carried out. Finally, a desired quantity of seed is filled in a container, weighed, labeled, sealed and .removed for storage.

Seed processing is based on differences in physical properties between seed and undesirable materials. Processing machines are chosen according to size, length, shape, weight surface texture, colour, etc affinity to liquid, electrical properties. A single machine does not do the entire job. Good seed processing is achieved when proper equipment are used.

Examples

(A) Seed cleaning equipment

(i) pre -cleaning equipment e.g scalper : rough clean various kinds of trash from the seed lot. It contains vibrating or rotating screen (or sieve) through which the small seed pass readily, while the larger seed and leaf matters are “scalped off and remove.

(ii) Air screen machine - farming mill makes use of air flow

(iii) Gravity separation

(iv) Length separation

(v) Width and thickness separation

(vi) Surface texture separation

(vii) Colour separation

(viii) Colour

(ix) Electro-static separation etc.

LECTURE SIX

Seed treatment

Seed treatment is recommended to minimize insect infestation, to prevent seed borne diseases and to protect the germinating seed from disease infection in the soil. Seed treatment serves as a disinfectant when the pathogens in seed are destroyed or inactivated and as a protectant when fresh entry of the pathogen is prevented.

Treated seed becomes unfit for human and animal consumption. The sign treated with "poison" should appear on seed bags and label. Only that quantity of seed should be treated for which demand is certain.

If insect infestation in seed store is satisfactorily controlled by sanitation and fumigation then it would be advisable to treat seed just before distribution when relatively clear picture of seed demand is available.

Seed packaging

Packaging is necessary to

-Facilitate handling and storage

-Comply with any legal requirement

-Preserve viability and seed quality

-Make a presentable product for selling

-Maintain varietal and lot identity

-Provide seed in popular sizes to cover an area ranging from $1/4^{th}$ to one hectare.

Types

1. Jute and paper bags Rice, maize, sorghum and cowpea seeds are commonly packaged in cotton jute and paper bags. Moisture vapour can penetrate these materials and hence they are not meant to protect against high RH: Such seed bags should be kept in dry storage condition.

2. Polyethylene bags : Alternatively, with inadequate storage facilities consideration could be given to packaging materials that can protect seed from moisture vapour. These include polyethylene bags of over 700 gauge thickness.

An essential precaution in using moisture proof containers, however, drying to a moisture level of 9% or less, otherwise seed can deteriorate rather fast. Owing to high cost and practical difficulties in meeting these conditions, jute bags appear to be the first choice at present. This, in conjunction with proper drying and good storage, is fairly adequate for six mouths storage over the dry season during which seed is usually held in Nigerian conditions.

Seed Marketing

Seed marketing is the process through which seed moves from the farm where it is produced to the consumer who plants it. Depending on the type of seed involved and proximity to site of use, the marketing process may be simply a farmer exchange or it may be a complicated transaction, involving several middlemen and a highly organized seed industry.

Seed marketing cycle.

Figure 3; A generalized seed marketing scheme

The sole purpose of producing seeds as to sell it. Good seed will often advertise and sell itself. To be cost effective, seed must be efficiently produced and efficiently marketed. Seed marketing is a complex task and calls for expert handling.

The reasons that make seed marketing different from marketing of other agricultural inputs are:

a) Seed is used by farmers in villages and remote farms. Thus the problems of rural marketing e,g lack of transport facilities, poor communications, limited purchasing power of a small farmers, inadequate storage facilities, insufficient motivation for the use of good seeds are to be confronted.
b) Seed is a living input very much prone to loss of viability. Therefore, require special treatment by marketing agency.
c) Seed production is characterized by an inflexible time tag which is also dependent on uncontrollable environmental conditions. Seed marketing, therefore, requires effective demand estimation sufficiently in advance.
d) Need for specific varieties for specific areas at specific time.
e) Any unsold stock at the end of season poses problems of safe seed storage besides tying down capital.
f) High sensitivity of seed to rh and temperature.
g) The rate of obsolescence is high as old varieties continually give way to better ones.
h) By virtue of cheapness, inferior seed is adopt to attract attention of a number of rural farmers.
i) Generating seed quality consciousness is a gradual process.

Seed marketing organization and management.

A marketing organization should develop a network of sale points in all potential areas.

It should maintain a close contact with farmers and lay stress on technical guidance as part of sale service.

The organization should be in a position to monitor farmers' reaction to crop varieties, pay prompt attention to complaints on seed quality and gather feedback on effective demand for each variety. The information demand is extremely useful in planning out a realistic seed production programme.

Please note that for effective marketing management, the following activities are involved in market operations.

- Market intelligence
- Marketing research
- Demand assessment
- Inventory control
- Seed storage
- Pricing
- Dealer development
- Logistics and seed movement
- Supply and transport
- Sales and collection of sale proceeds
- Promotion and publicity.
- The entire seed production effort is meant to satisfy the end user old seed. Therefore, effective marketing distribution, organization and management should engage fullest attention, if seed programme is to make an impact it is expected to make.

LECTURE SEVEN

Seed Laws

The first seed law says *" Thou shall not sow thy field with mingled seed* (Lev. 19:19).

Seed laws are designed to aid in the orderly marketing of seed. It established to promote use of high quality seed. Seed laws are established regulations governing the sale of seed, thereby providing legal protection to both buyers and sellers. No country can expect to have a well developed, effective seed industry without seed control regulations. It also protects agric productivity of a country. In US, seed legislation exists at both the state and federal levels.

Legislative strategy

Two types of seed legislation

1. Truth in labeling and 2. minimum standard

which type of legislation is more appropriate for any particular situation is a matter of judgment in the light of local circumstances.

Truth in labeling

Is the basic purpose of both state and federal seed laws. The concept was developed to avoid the type of philosophy prevalent in the English markets.

It is most suitable for sophisticated farmers, (who are able to analysis the information given and assess its importance, and who are economically able to make some choice e.g USA.

Minimum standard

This legislative strategy is suitable to peasant farmers who cannot appreciate information on the label.

Provisions of state and federal seed laws

Farmers seed exchange : Are exempted from labeling laws.

Current germination tests.

Labeling vegetable seed containers : Minimum germination standard on the labels.

Transport for processing : No need of labeling laws

Disclaimers not allowed : statement of disclaiming responsibility or on the label not allowed.

Collection of damages: No damages may be collected through seed laws but through civil court action.

Proof of intent not needed : violators could be penalized without proof of intent, or carelessness.

Coloration and labeling of treated seed : put poison in red letters skull and crossbones on the labels.

Imported seeds : screening of imported seeds for noxious weed seeds etc.

Noxious weed seeds : prohibiting and restriction of weed seeds (e.g primary and secondary noxious weeds seeds).

Keeping of Records

Labeling : labeling must be attached to seed containers.

Definition of seed quality terminology

Amending seed laws

Definition of sale or offer for sale

Appointment of salesman, oral and written advertisements, price lost, catalogue, pamphlets.

Breeders' Rights

The plant variety protection Act : Legal protection for crop varieties.

The plant variety protection Act (breeder right was signed into law in 1970). The act provides legal protection in the production and sale of seed by owners or developers of new varieties of sexually propagated crop. Developers of asexually propagated (budding or grafting etc).

The act provides two avenues of protection of owner of a variety.

First, it gives him the exclusive right to the propagation and use of a protected variety. In cases of infringement, however, the owner is responsible for depending this right in a civil count.

Second, it gives the owner the right to stipulate in his application that the variety name be protected through seed certification.

A special example for farmer: grants them the right to produce seed of a protected variety for their own use and for sale to neighbours for planting. Plant breeders may also use protected varieties for breeding purpose. Use for breeding purpose does not constitute infringement of the variety protection act.

The body: The international Treaty on Plant Generic resources for Food and Agriculture, FAO.

Farmer's Right

- Recounting of the enormous contribution that farmers and their communities have made and continue to make to the conservation and development of PGR.
- The right include

Protection of traditional knowledge

The right to participate in benefit- sharing and in national decision making about PGR

- Right to save, use exchange and sell farm-saved seeds

Governments are responsible for realizing this right.

LECTURE EIGHT

Seed Programme Development

New and improved crop variety become a significant agric input only when pure high quality seeds are available to and be planted by the cultivator.

Justification and Mission of the seed program development is the extension of superior varieties performance demonstrated in breeding institution and test plots to all crop and where the variety are adapted.

This movement is best accomplished through organized and systematic efforts through both private and public institution and personnel.

A seed industry program consists of the following:.

1. Crop improvement and plant breeding program of which is seed program is an essential plant
2. Availability of seed- seed of most major crops are required multiplying input, have seeds are unique among production input in crop husbandry.
3. An efficient seed industry is the rapid rehabilitation of agriculture, a part from serving in agricultural development.
4. A completely objective economic and technical justification for effective seed programme industry.

Specific benefits of seed programme that produces and supplies a high quality seed of improved variety include:

1. increase in total yield resulting in introduction and the cropping pattern the society.
2. increase in yield resulting from higher physiological quality of plant seed (individual more production plant).
3. increase in recoverable yield as a result of greater varietal purity, more uniform maturation etc
4. more efficient utilization of fertilizers, irrigation and pesticides because of greater information of encourage and growth, better stands or more rigorous plants.
5. Reduction in plant rate when high quality seeds are available. The seed rate can be reduced by one half i.e 1ton - ½ ton.
6. Higher quality of production because of less contamination with other variety and more uniform maturation, have fever immature or withered seed.
7. Less re-infestation of the land with weed seeds.
8. Less disease in the soil and soil insect problem in seed beds and in the field as a result of immunization of plants infected by seed borne disease in seed production farm.
9. More rapid and efficient periodic replacement of variety.
10. Facilitate introduction of new crops into the agriculture of a region country.
11. Contributing to agric develop of a country.
12. Employment opportunity
13. Contributing to nation economic (GDP) growth.
14. Quality control.

Essential demand of seed programme are:

1. skilled knowledgeable manpower
2. Early development efforts were concentrated in the need for diffusion of efforts to build solid and pragmatic seed programme.
3. The quality of input into the programme.
4. The time frame is realistic, no crash program
5. Planning, evaluation and implementation

Sampling of Agricultural seeds

The importance of a representation sample must truthfully represent the quality of the seed lot from which it is drawn.

Seed sampling is usually done in two steps.

First, the sample to be submitted to a seed laboratory is drawn from the bulk seed lot and sent to the laboratory for analysis. This is known as the **submitted sample**.

Second, when it reaches the laboratory, it must be further divided to a size that can be analyzed. This latter sample is used for the actual analysis and is called the working sample.

Submitted sample

Regardless of the condition, the seed lot must be properly sampled so that the sample is representative. There are rules for sampling by AOSA and ISTA. It provides for use of mechanical samplers, by use of standard sampling probes, tiers, by land or by taking the entire container as the submitted sample.

Sampling process

A. **Bulk seed** : a trier or proble, is recommended though hand may also be used by taking a handful from well distributed points throughout the bulk. Hard sampling is limited by the difficulty of reading all portions of large bulk lots whereas large probes (72 inches) in length can be used.

B. **Seed Bags** : when a seed lot consists of six bags or less, each bag should be sampled for well distributed point throughout the bags. If more than six samples from 5 bags plus 10% of the remaining bags.

C. **Seed small container** : seed in small containers should be sampled by taking at random an entire unopened container from the supply in order to obtain the minimum amount required for the working sample.

Subdividing the sample

Sample drawn from the various feeling may be too large for the submitted sample and should be subdivided before submitting to the laboratory. Avoid bias during division.

Mailing the sample

Labeled and placed in container. E.g place and address of owner, crop kind or the variety, tests required, lot number and number and lot of containers and bags.

Sub sampling

When the submitted sample arrives the seed laboratory. It is entered in the official log book and assigned a number and the accompany information is recorded. The sample then goes to the sub sampling areas in the laboratory and further divided into working samples and then assessed for the various tests. E.g purity, germination and others. The remaining portion of the sample is retained as an official sample in case of future tests are required.